



# **Development of Range Reference Atmospheres V.2013/2014**

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# Range Reference Atmosphere Background

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- Range Reference Atmosphere (RRA) datasets are statistical upper-air climatologies of specific geographical locations.
- The Range Commanders Council (RCC) have been publishing RRAs since 1963, with updates produced. Two “milestone” series were produced in 1983 and 2006.
- In late 2012, the NASA/MSFC Natural Environments Branch initiated production of a new series of RRA updates. These are referred to as the 2013/2014 versions.
- To date, four RRAs have been completed (CCAFS, EAFB, VAFB, WSMR). Development of these four were funded by the NASA Space Launch System program.
- The RCC has funded a proposal to create RRAs for an additional ten sites. Work on these is ongoing.

# RRA 2013/2014 Dataset Contents

Meteorological Parameter	Statistical Quantities
Geometric altitude (Z)	Vertical coordinate (independent variable)
Zonal wind component (U)	Mean, median, standard deviation
Meridional wind component (V)	Mean, median, standard deviation
Wind component correlation ( $R_{UV}$ )	Linear product-moment correlation
Wind speed (WS)	Mean, median, standard deviation, skewness
Number of wind observations	Arithmetic sum
Atmospheric pressure (P)	Mean, median, standard deviation, skewness
Atmospheric temperature (T)	Mean, median, standard deviation, skewness
Atmospheric density (D)	Mean, median, standard deviation, skewness
Number of thermodynamic observations	Arithmetic sum
Water vapor pressure (VP)	Mean, median, standard deviation, skewness
Virtual temperature ( $T_v$ )	Mean, median, standard deviation, skewness
Dewpoint temperature ( $T_d$ )	Mean, median, standard deviation, skewness
Number of moisture observations	Arithmetic sum

Values given every 0.5 km from surface to 30 km  
 Monthly, annual tables. No time of day resolution

# Range Reference Atmosphere Sites

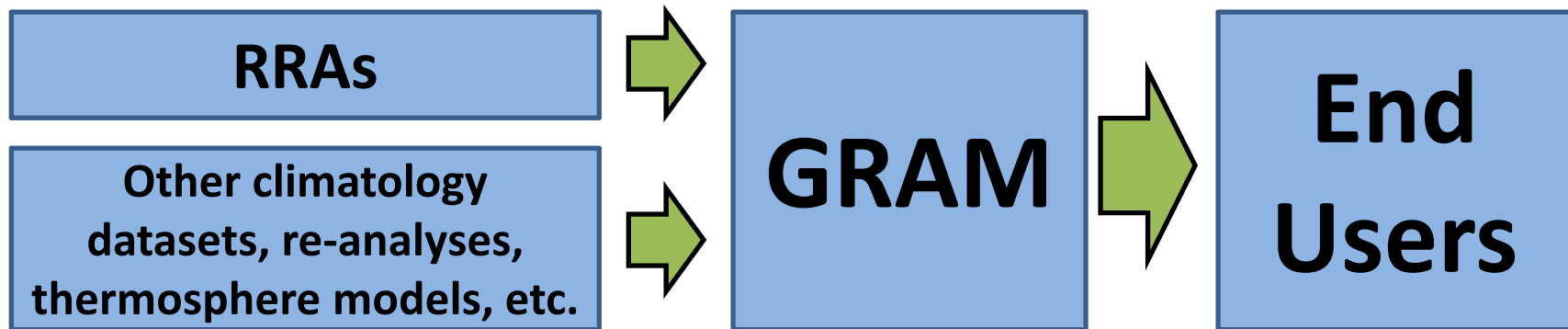
RRA Site Locations	1983	2006	2013/2014
Argentia, New Foundland		✓	
Ascension Island, Atlantic ocean	✓	✓	
Barking Sands, Hawaii	✓	✓	
Cape Canaveral, Florida	✓	✓	✓
China Lake Naval Air Weapons Station, California		✓	In process
Dugway Proving Ground, Utah	✓	✓	In process
Edwards Air Force Base, California	✓	✓	✓
Eglin Air Force Base, California	✓	✓	In process
El Paso, Texas		✓	
Fort Huachuca Electronic Proving Ground, Arizona		✓	
Fairbanks, Alaska	✓	✓	
Great Falls, Montana		✓	
Kodiak, Alaska	✓		In process
Kwajalein, Marshall Islands	✓	✓	In process
Nellis Air Force Base, Nevada	✓	✓	
Nimes-Courbessac, France		✓	
Point Magu Naval Air Warfare Center, California	✓	✓	In process
Roosevelt Roads, Puerto Rico		✓	
Shemya, Alaska	✓		
Taguac, Guam	✓	✓	
Thule, Greenland	✓		In process
Vandenberg Air Force Base, California	✓	✓	✓
Wake Island, Pacific Ocean	✓		In process
Wallops Island, Virginia	✓	✓	In process
White Sands Missile Range, New Mexico	✓	✓	✓
Yuma Proving Ground, Arizona		✓	In process

	0-30 km vertical domain
	0-70 km vertical domain

# RRA Application

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## Earth-Global Reference Atmospheric Model (Earth-GRAM)



The four completed 2013/2014 RRAs are now integrated into Earth-GRAM Version 4, which is available free of charge.

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Access: [http://see.msfc.nasa.gov/tte/model\\_gram.html](http://see.msfc.nasa.gov/tte/model_gram.html)

# Questions

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